Directorate of
Intelligence

Confidential

25X1

Soviet Coal Industry in the Doldrums

25X1

An Intelligence Assessment

Confidential

SOV 82-10134
September 1982

Copy 433

Directorate of Intelligence

Confidential

Soviet Coal Industry in the Doldrums

An Intelligence Assessment

This paper was prepared by
Soviet Economy Division, with a contribution from Econometric Analysis Division, Office of Soviet Analysis. Comments and queries are welcome and may be directed to the Chief, Soviet Economy Division, SOVA.

Confidential
SOV 82-10134
September 1982

25X1

Soviet Coal Industry in the Doldrums

25X1

Key Judgments

Information available as of 20 August 1982 was used in this report.

Coal will not relieve the energy crunch facing the USSR during the 1980s. Substitution of coal for oil is likely to be negligible for at least a decade; even if large-scale interfuel substitution were possible, the Soviet coal industry is poorly equipped to increase production.

The USSR's coal output fell to 704 million metric tons in 1981—marking the third consecutive annual decline and the sixth consecutive year in which production has fallen far short of plan. Production in the Soviets' largest coal-producing region (the Donets basin) is falling faster than Moscow anticipated, and production in many other basins is stagnating. Even in basins where output is increasing (such as Ekibastuz), expansion has been much less than planned.

Four major problems are hampering the Soviet coal industry:

- Mining conditions in underground operations are deteriorating rapidly.
- The amount of new capacity coming on stream is too small to offset the stagnation or decline of production in older coal basins.
- Shortages of labor and declines in labor productivity are becoming more acute, especially in the basins of the western USSR.
- Development of the large basins east of the Urals is constrained by the poor quality of these deposits, slow research progress on coal enrichment, lack of transportation capacity, and/or unresolved technical problems in transmitting electricity produced at mine-mouth power stations.

These problems have boosted the real cost of coal investment and production.

During the 1970s, Soviet policymakers held a series of discussions to review the coal industry's problems and the advantages of increased oil and natural gas supplies to the economy. The sharp curtailment in the share of investment available to the coal industry reflects the outcome of these energy policy meetings. Advocates of oil and gas appear to have won with their arguments that the coal industry is not a reliable energy supplier because coal quality is declining and the energy return on investment is much less for coal than for the other two fuels.

Soviet plans call for coal production to increase to 775 million tons by 1985—a lower goal than was once planned for 1980, but still impossible to achieve. As a result of further research and the developments of the past two years, we have lowered our estimate of output for 1985 from 775

million tons to a midrange estimate of 720 million tons. Even this estimate must be discounted, because coal output expressed in terms of standard fuel would not increase until the mid-1980s at the earliest due to the continuing decline in energy content of the coal being mined.

Practically all of the estimated increase in coal output in the 1980s will come from eastern basins—primarily from expanded operations at Ekibastuz in northern Kazakhstan, but also from Kansk-Achinsk in eastern Siberia. Difficulties in transporting Siberian coal (or electricity produced from that coal) to the main energy-consuming areas of European Russia, as well as technical problems in developing a combustion system that can burn it satisfactorily, will delay a major expansion at Siberian basins for at least a decade.

In the 1980s, tight coal supplies will sharply curtail Soviet plans to build large coal-fired thermal power plants, undercutting plans to use more coal (and less oil) as fuel for power plants. To limit the use of oil, the Soviets will have to place more reliance on natural gas as fuel for power production.

Moreover, we project that Soviet production of coking coal will be 30 to 40 million tons below the level needed to support the target for steel output and other industrial uses (including export commitments) in 1985. The shortfall in domestic production of coking coal will force the Soviets to either: (a) reduce targets for steel production, (b) substantially increase coal imports, (c) reduce coal exports, or—more likely—(d) adopt some combination of these options.

25X1

Contents

25X1

Figures

[redacted]

25X1

Preface

This assessment gives special attention to problems limiting coal production and to the potential impact of tight coal supplies on the Soviets' plans for the production of electric power and steel—activities that account for almost three-fourths of their coal consumption.

25X1

25

[redacted]

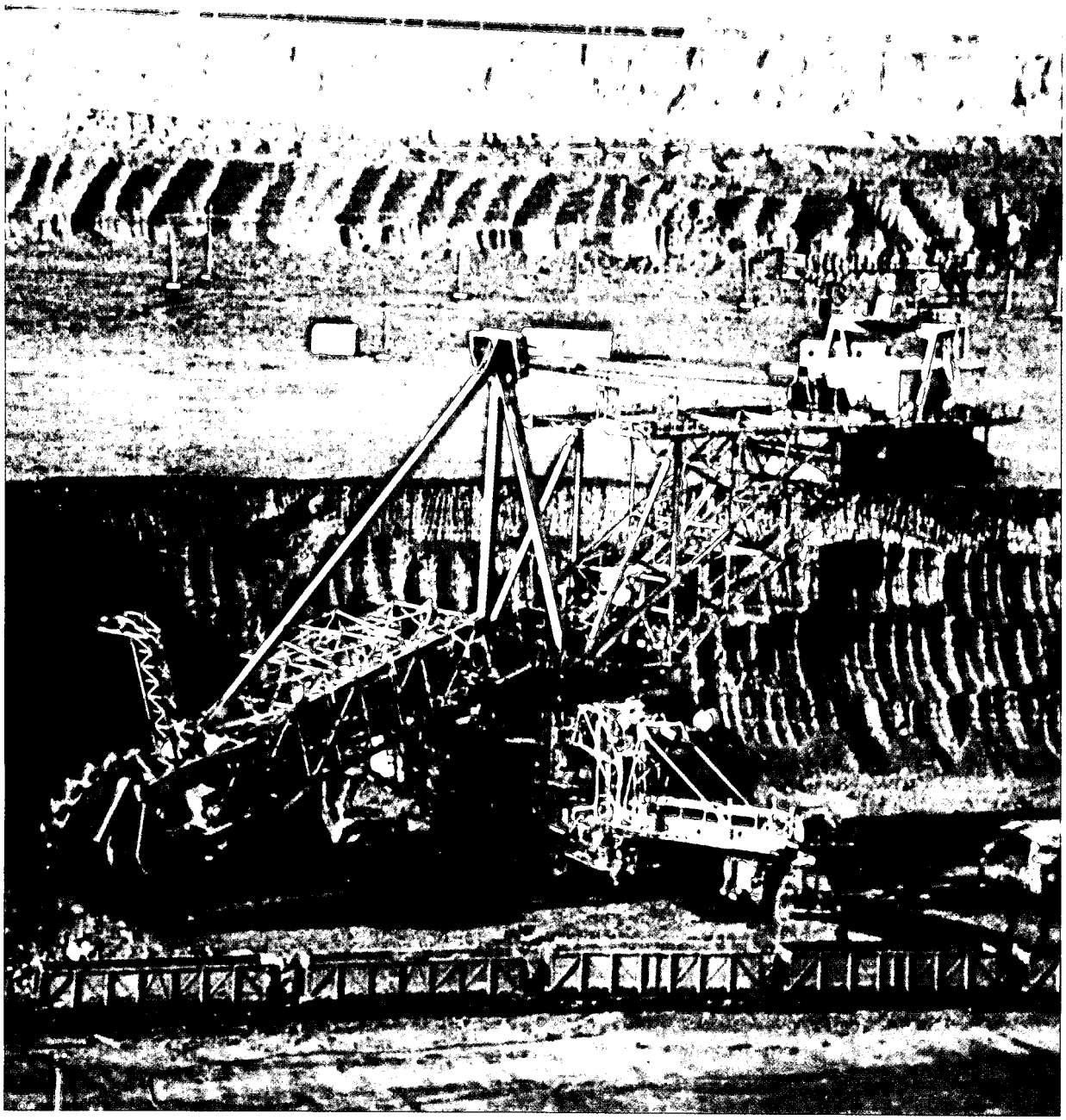
25X1

Unless otherwise indicated, the production figures used in this report refer to raw coal. Because of differences in raw coal quality (heat value) over time or between basins, our comparisons refer to output converted to *standard fuel* units—the amount of coal necessary to obtain the heat equivalent of 7,000 kilocalories per kilogram or 12,600 BTU per pound.

[redacted]

25X1

25X1



Open pit mining with a bucket-wheel excavator. This high-capacity equipment is being used more extensively in the Ekibastuz and Kansk-Achinsk coal basins. See the "Production Outlook" section for detailed commentary on these regions.

25X1

Soviet Coal Industry in the Doldrums

25X1

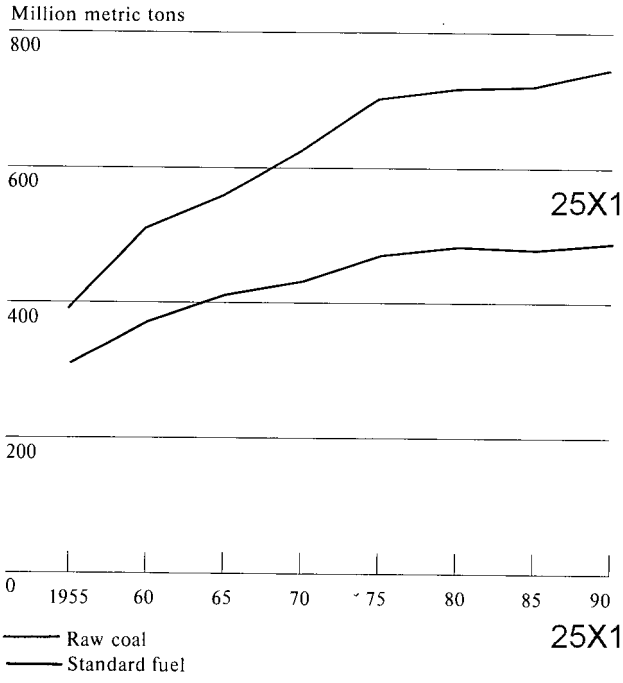
Production Record

From 1955 to 1975, the Soviets were notably successful in raising coal production. Output increased by about 3 percent annually, and production goals were consistently met or overfulfilled. Nevertheless, the USSR, like other industrialized countries, was moving away from coal as a primary energy source in favor of oil and natural gas, which burn more efficiently and are easier to transport. As a result, coal's share of Soviet primary energy production dropped from over 50 percent in the mid-1950s to roughly 25 percent in 1980.

Small annual production gains continued until 1978, followed by three years of decline. Raw coal output rose to a peak of 724 million tons in 1978 but by 1981 had slipped to 704 million tons. The 1980 output was 90 million tons short of the original target for that year. The USSR's production of coal, expressed as standard fuel,[2] fell relatively even more, because average coal quality declined in all major basins and because low-grade Ekibastuz and Kansk-Achinsk coal made up an increasing share of the total output. This development is illustrated by the increasing gap between the output trend lines in figure 1.

With the notable exception of the Ekibastuz basin in northern Kazakhstan, coal production at most of the major Soviet coal basins (shown in figure 2) is now stagnant or in decline. Production in the Donets basin—the country's largest producer—has dropped by 21 million tons since its 1976 peak, to 204 million tons in 1980. Production in the Kuznetsk basin, the country's second largest, is declining as well. Output there fell to 144 million tons in 1980; this was

Figure 1
Soviet Coal Output Trends in Terms of Raw Coal and Standard Fuel Equivalent



Note: The output trends are based on comparisons at five-year intervals; therefore annual variations are not shown.

25X1

587533 9-82

5 million tons less than the peak output achieved in 1978 and 18 million tons short of the original 1980 target. Output also fell in the smaller basins near Moscow and in the Urals. Together, annual production in western coal basins has fallen by about 30 million tons since 1977.[3] In 1981 alone, the decline was about 12 million tons (table 1).

25X1

25X1

[2] The heat value of coal is measured in terms of standard fuel having a calorific value of 7,000 kilocalories per kilogram (12,600 BTUs per pound). One ton of standard fuel has the energy equivalent of 5.1 barrels of oil or 844 cubic meters of natural gas. The calorific values of Kansk-Achinsk and Ekibastuz coals are about 3,600 and 3,800 kilocalories per kilogram, respectively.

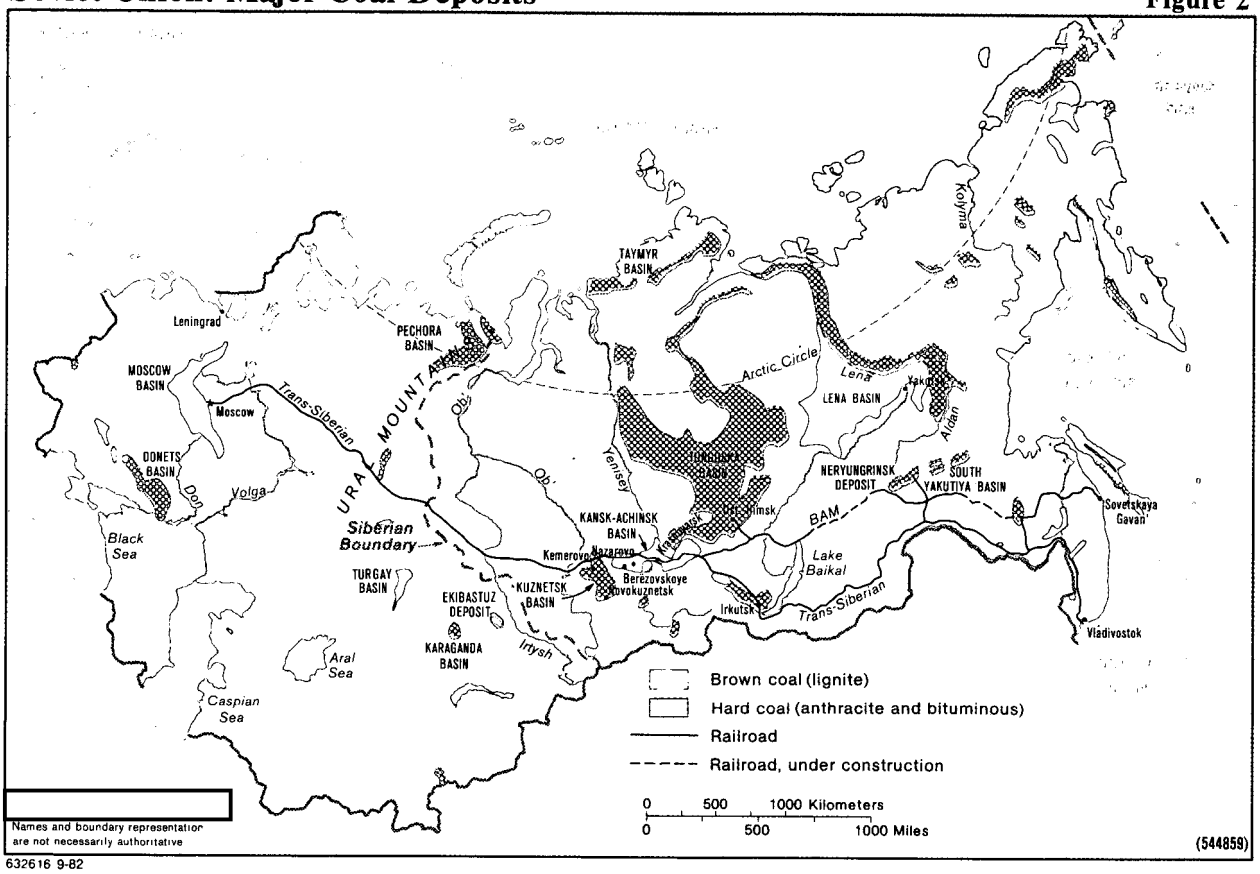
[3] Currently, only coal production statistics for the USSR as a whole and for Kazakhstan are being systematically reported. Regular reporting of output by republics ceased in the mid-1970s except for the RSFSR, Ukraine, and (until 1977) Kazakhstan. In 1981 RSFSR and Ukraine reporting ceased, and Kazakhstan statistics were restored.

25X1

25X1

Soviet Union: Major Coal Deposits

Figure 2



25X1

Neither the CIA nor Soviet planners had anticipated a decline in production from the older basins so soon. The original plan for 1976-80 called for production to increase at the Donets basin by 10 million tons and at the Kuznetsk basin by 25 million tons, while production at the Moscow and Karaganda basins was to be stabilized. The plan succeeded only at Karaganda. The Soviets clearly hoped that declines in the aggregate production of the older coal basins could be forestalled at least until the late 1980s, when the new coal basins of the eastern USSR would start to play a major role in production.

The Ekibastuz coal basin is the only large basin where production has increased substantially since 1975. Production rose from 46 million tons in that year to 68 million tons in 1981. In the case of Ekibastuz, however, raw coal production figures must be heavily discounted. Ekibastuz coal has a low heat content (only 60 to 70 percent that of Donets and Kuznetsk coals), and none of it is suitable for coking.

25X1

Soviet Coal Problems

Our analysis shows that four major problems are hampering Soviet coal production:

- Mining conditions in underground operations are deteriorating rapidly, especially in the Donets and Kuznetsk basins.

25X1

Table 1
Soviet Production of Raw Coal, by Basin [a]

Million metric tons

	1975	1978	1979	1980	1981	1985 Plan [b]	1985 Estimate [c]	1990 Estimate [c]
Total	**701**	**724**	**719**	**716**	**704**	**775**	**720**	**745**
Western USSR	366	352	346	338	326	341	308	285
Donets	223	212	208	204	198	210	190	175
Moscow	34	29	27	25	22	20	15	10
Pechora	24	28	28	28	28	28	28	30
Urals	45	45	45	44	43	45	40	35
Other	40	38	38	37	35	38	35	35
Eastern USSR	335	372	373	378	378	434	412	460
Ekibastuz	46	57	59	66	68	84	80	110
Karaganda	46	48	48	49	49	50	50	40
Kuznetsk	138	149	148	144	144	154	140	145
Kansk-Achinsk	28	32	32	35	35	48	48	65
South Yakutiya	0	1	2	3	3	12	8	12
Other	77	85	84	81	79	86	86	88

[a] Data for 1975 are from the No. 4 issue of *Ugol';* data for 1978-81 are based principally on various issues of *Ekonomicheskaya gazeta.*
[b] From the 11th Five-Year Plan, 1981-85, with CIA interpolation of data omitted by the Soviets.
[c] These are CIA estimates; for projections of 1985 and 1990 production estimates, see "Production Outlook" section.

25X1

- The amount of new capacity coming on stream is too little to offset the stagnation or decline of production in older coal basins.
- Shortages of labor and declines in labor productivity are becoming more acute, especially in the older coal basins in the western USSR.
- Development of the large basins east of the Urals is constrained by the poor quality of these deposits, slow research progress on coal enrichment, lack of transportation capacity, and/or unresolved technical problems in transmitting electricity produced at mine-mouth power stations.

These problems have been boosting the real unit cost of coal production and contributing to lags in the program to substitute coal for oil in major uses such as electricity and heat generation. Future coal investment decisions will become more difficult. While outlays per unit of output are rising for both the costly underground mining and the less expensive surface mining, costs at surface mines are rising faster because of growing outlays for support facilities (equipment maintenance, for example), housing, and community services (such as schools and stores).

25X1

At the Donets basin, mining conditions are among the worst in the world.[4] In terms of mine depth, seam thickness, and methane concentrations, most of the Donets mines would no longer be considered in the category of proved reserves by Western standards. The average depth of the Donets mines was almost 600 meters in 1980—eight times as deep as the average US coal mine—and double the average depth of other Soviet coal mines. The average thickness of Donets coal seams was less than 1 meter in 1980—three-fourths as thick as the seams being worked a decade earlier and about one-half as thick as average coal seams in the United States and West Germany. Moreover, most of the Donets mines have dangerously high concentrations of methane, which require the installation of costly methane drainage equipment. As mining conditions worsen and unit costs of production rise, Soviet planners have found it increasingly difficult to justify additional investment and labor inputs. Similar problems, albeit somewhat less severe, underlie the declining production at other old Soviet coal basins, such as Kuznetsk, Karaganda, and Moscow.

Development of the large, new basins east of the Urals, notably Ekibastuz and Kansk-Achinsk, is constrained by a number of factors. Although Soviet estimates of reserves in these two basins are large, totaling 120 billion tons, their quality is poor. Both low coal quality and distance from the central industrial region make large-scale rail shipment from Ekibastuz and Kansk-Achinsk uneconomic. Realizing this, the Soviets are attempting to develop technology for improving the quality of the coal prior to shipment. In addition, they are working on long-distance electricity transmission systems which could provide industrial areas in European Russia with power generated at mine-mouth stations located east of the Urals. Because there have been no research breakthroughs on these problems and only slow progress since the early 1970s, production at the new basins is now largely confined to supplying regional needs. Major expansion of Ekibastuz and Kansk-Achinsk will be delayed until the technologies are ready for commercial use and their construction is funded by major investment.

25X1

Increased investment in the coal industry is needed not only to develop new coal basins but also to forestall production declines in older basins. Nevertheless, the coal industry share of energy investment has been in decline for some years. From the mid-1960s to 1980, Soviet investments in oil and gas rose by about 300 and 400 percent, respectively, but investment in the coal industry rose by only 50 percent. As a result, coal's share of investment in all fossil-fuel industry fell from about 35 percent in the mid-1960s to about 20 percent in 1980 (see table 2).

25X1

25X1

Debate Over the Role of Coal. The sharp curtailment in the growth of investment available to the coal industry reflects the outcome of key Soviet policy debates of the past two decades concerning the question of whether primary emphasis should be on coal or on oil and gas.[5] These debates were inevitably colored by the fact that energy industries generally require large investments that do not provide substantial returns until after many years. Soviet policymakers faced the task of setting priorities among the following: expanded oil and gas production in Siberia, increased coal production (especially surface mining in eastern regions), rapid growth in nuclear power, and conservation of energy.

25X1

25X1

[4] Although, as shown in the tabulation, the depth of mines in some West European countries exceeds that of the Donets basin, the West European seams are thicker, permitting a greater degree of substitution of machinery for labor at these extreme depths.

	Average Depth (*meters*)	Average Seam Thickness (*meters*)
USSR (all underground mines)	421	1.35
Donets	566	0.90
United States	70	1.65
United Kingdom	366	1.30
France	564	1.59
West Germany	756	1.54

Source: *Ekonomicheskiye problemy tekhnicheskogo progressa v ugol'noy promyshlennosti UkSSR*, Naukogo Dumka, Kiev, 1976, p. 23. See also *Ugol'naya promyshlennost' SSSR za 60 let*, TSNII Ugol', 1977, pp. 38-40.

25X1

Table 2
Soviet Investment in Fossil-Fuel Industries [a]

	Total	Coal	Coal Share (*percent*)
1960	2,708	1,163	42.9
1965	4,044	1,389	34.3
1970	5,024	1,502	29.9
1975	7,289	1,710	23.5
1980	10,894	2,094	19.2

Source: TsSU, *Narodnoye khozyaystvo SSSR, v - godakh.*

[a] *Million rubles, in comparable prices.*

25X1

Advocates of both coal and petroleum had persuasive arguments to support their positions that were widely reported in Soviet newspapers and journals. Coal advocates held that development of coal would enable savings in oil and natural gas, fuels that could be used more efficiently as exports and chemical feedstocks. They also argued that the Kansk-Achinsk basin was the key to an expanded role for coal. Unlike other basins, Kansk-Achinsk has coal reserves large enough to yield annual production of up to a billion tons, an accessible location along the Trans-Siberian railroad, and the high labor productivity typical of surface mining. In their view, Kansk-Achinsk coal was among the cheapest fuels available. Advocates of oil and gas asserted that the coal industry was not a reliable energy supplier because coal quality was declining and the energy return on investment was much less for coal than for the other two fuels.

In 1969-70 the Minister of Coal and energy experts from the Academy of Sciences concluded that in the long term oil and gas would be inadequate to meet energy needs. During the drafting of the 1971-75 Plan, this group reportedly submitted a paper to the Politburo, arguing the case for Kansk-Achinsk development and the substitution of coal for oil and gas.[6]

The proposal was rejected because the Politburo considered the costs to be excessive. Development of Kansk-Achinsk was delayed for 20 to 25 years—unless a breakthrough in transportation technology should occur in the meantime. Thus, in the early 1970s, adoption of a coal-centered energy strategy was rejected.

25X1

An intense examination of energy production policy followed, however, in the Academy of Sciences, the State Committee for Science and Technology, and the State Planning Committee (Gosplan), and by 1975 public statements by spokesmen for these organizations showed that a strong consensus had crystallized among top-level energy advisers favoring accelerated development of coal production and advanced technologies for electricity production. After heavy lobbying, this opinion was incorporated in the 1976-80 Plan.

25X1

Implementation of a new policy line on coal was very slow. A fundamental problem was (and is) how best to use the potential energy of Kansk-Achinsk coal. Some of the coal is to be burned in mine-mouth generating plants to supply power for local needs. On the use of Kansk-Achinsk coal to supply energy to other areas, however, differences in opinion have persisted. There have been proposals to build:

- Large mine-mouth generating stations and ultra-high-voltage lines for transmitting the electric power to the European USSR.
- A special broad gauge coal railway from Kansk-Achinsk to central Russia.

25X1

- A slurry or capsule pipeline.
- A superconductive cable.
- Facilities for coal liquefaction, gasification, or the production of thermocoal (dried coal) or semicoke (similar to charcoal). The product would be either shipped west or used as an enriched fuel for power generation.

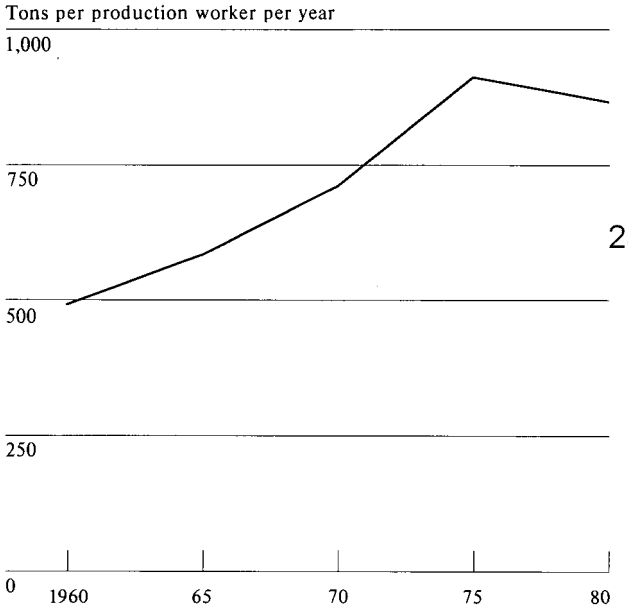
25X1 25X1

The controversy over whether coal or, alternatively, oil and gas should be the centerpiece of Soviet energy policy appears to have been resolved, at least for the 1981-85 period. In the current Five-Year Plan, gas industry investment, mostly in West Siberia, is planned to double. It appears that the Soviets now consider increased gas production the answer to growing domestic energy requirements and the need to bolster hard currency earnings. With much larger investments required just to maintain output in the oil industry and to carry out the ambitious nuclear power program, the share of energy investment allocated to coal is likely to continue to decline during the 1980s.

The inadequacy of Soviet investment in the coal industry has resulted in more rapid depletion of older mines, especially in the coal basins of the western USSR. Even so, because an increasing share of the coal industry's limited investment is needed to maintain capacity in existing mines, the commissioning of new capacity has also slowed.

Attempts To Deal With the Labor Constraint. Shortages of labor and falling labor productivity have become increasingly serious at both underground and surface mines.[7] The abrupt falloff in labor productivity since 1975 is illustrated in figure 3. The steady deterioration in the work environment, especially in the older Soviet coal basins, and the austere living conditions in the newer basins in the eastern USSR have made it difficult to find enough miners, despite relatively high wages. To attract additional workers, the average workweek in the Donets basin, for example, has been cut since 1976 to 30 hours, compared with 36 to 38 hours in other basins. Shortening the workweek has not increased recruitment, however. Instead, it has forced mine managers to transfer manpower from maintenance to production activities,

Figure 3
Labor Productivity in the Soviet Coal Industry, 1960-80



Note: Productivity of Coal Ministry workers is shown here. The Coal Ministry produces more than 99 percent of Soviet coal.

587534 9-82

25X1

according to Soviet press interviews with mine workers and supervisors.[8] They are more likely to meet short-term output goals in this way, but failure to maintain equipment properly will eventually cut into production.

25X1

In 1982 Moscow raised the average wage for coal miners by as much as 27 percent, with additional premiums for especially difficult conditions. Nonetheless, local coal industry officials indicate that without

[8] *Trud*, 21 September 1980, p. 2, and *Sotsialisticheskaya industriya*, 24 June 1981, p. 1

25X1

25X1

25X1

25X1

additional steps to improve the living conditions of the miners and the availability and variety of consumer goods, the pay increase probably will do little to attract additional workers.[9]

Labor productivity is also reduced by frequent and lengthy breakdowns of open pit mining machinery and growing shortages of underground mining equipment. Millions of tons of output were lost in 1979, for example, because one of the largest excavators at Ekibastuz was out of service for about one-third of the year. shortages of longwall mining equipment, safety gear, and specially designed underground excavating machinery are hampering production, especially in the Donets and Kuznetsk basins.[10]

Production Outlook

Coal production is slated to increase to 728 million tons in 1982. This goal will not be achieved. The industry produced 704 million tons in 1981, and to fulfill the plan would require an increase in production larger than any the Soviets have achieved in almost 20 years. Data for the first seven months of 1982 indicate that production rose above the depressed level of the same period in 1981, ending the decline that began in 1979. Production in 1982 will probably be 710-715 million tons—marking the seventh consecutive year that output has fallen far short of plan 25X1

The 1981-85 Plan calls for coal production to increase to 775 million tons by 1985. If our estimates of annual mine depletion are reasonably accurate, gross annual commissionings of coal-mining capacity would have to increase to about 26 million tons per annum during 1981-85 if that goal is to be achieved. (The increase was 18 million tons per annum during 1976-80.) The Soviets have never commissioned new coal-mining capacity at this rate.

25X1

[9] *Sotsialisticheskaya industriya*, 8 July 1981, p. 2, discusses worker reactions to the lack of housing and community services at Ekibastuz. *Pravda*, 25 December 1979, p. 3, describes an annual turnover of 3,000 miners in Kazakhstan because of insufficient housing

[10] The severity of equipment shortages, particularly in the Donets and Kuznetsk basins, is noted in *Ugol'*, No. 8, 1979, pp. 4-10, and *Pravda Ukrainy*, 4 August 1981, p. 2.

During 1976-80 gross annual commissionings of new capacity fell to an average of about 18 million tons, the lowest level in almost a decade. At the same time, annual mine depletion increased to about 15 million tons, up from about 7 million tons a decade earlier. In other words, Soviet data suggest that more than 80 percent of gross annual commissionings now simply offset mine depletion.[11] 25X1

The 1981-85 Plan hinges on achieving rapid increases in production at Ekibastuz and small increases at the Donets and Kuznetsk basins. Ekibastuz may perform as planned (substantial increases in production are likely there), but there is little chance of an increase at the others. Indeed, we expect output in these two basins to fall at least until 1985. 25X1 25X1

Taking into account lagging production in older coal basins and less-than-hoped-for increases at basins in the eastern USSR, we estimate that Soviet coal production could reach only 715-725 million tons by 1985. We expect that the Soviets will accelerate yearly increases in Ekibastuz output, raising total output to between 735 and 760 million tons by 1990. We think 745 million tons is the most likely figure. This estimate for 1990 assumes not only that the Ekibastuz output grows at an increasing rate but also that technical problems involved in transporting Kansk-Achinsk coal are overcome, that boilers adapted to this coal are developed, and that investment in the coal industry is large enough. Soviet failure in any one of these areas would lower our projection substantially. 25X1

All of the gain in raw coal production through 1985, however, will be offset by the continuing decline in the average energy content of the coal being mined.[12] We believe that coal production—expressed as standard

[11] We define depletion as the amount of operating capacity lost because of mine exhaustion and the decreased productivity of older mines that are still operating

[12] Coal users in the metallurgical and power industries have strongly objected to falling coal quality and energy value. For comments from Soviet metallurgists, see *Komunisti*, 2 October 1981, p. 2, and *Pravda*, 17 November 1980, p. 2. For criticisms by the electric power industry, see *Kazakhstanskaya Pravda*, 29 November 1981, p. 2, and *Izvestiya*, 8 December 1979, p. 2

25X1 25X1 25X1 25X1

Table 3
Soviet Coal Production

	Raw Coal (million metric tons)	Standard Fuel Equivalent (million metric tons)	Average Calorific Value [a] (kcal/kg)	Average Calorific Value [a] (BTU/pound)	Calorific Index Value (1955=100)
1955	389.6	310.8	5,584	10,051	100.0
1960	509.6	373.1	5,125	9,225	91.8
1965	557.7	412.5	5,178	9,320	92.7
1970	624.1	432.7	4,853	8,736	86.9
1975	701.2	471.8	4,710	8,478	84.3
1976	711.5	479.0	4,713	8,483	84.4
1977	722.1	486.0	4,711	8,480	84.4
1978	723.6	487.0	4,711	8,480	84.4
1979 [b]	718.7	486.2	4,711	8,480	84.4
1980 [b]	716.4	484.4	4,711	8,480	84.4
1985 [c]	720.0	480.0	4,667	8,400	83.6
1990 [c]	745.0	490.0	4,604	8,287	82.4

[a] Data are from annual issues of TsSU, *Narodnoye khozyaystvo SSSR.*
[b] Data for the average calorific values of coal produced in 1979 and 1980 are based on the trend observed since the mid-1970s.
[c] CIA estimates.

25X1

fuel—will stagnate at about 480 million tons through the mid-1980s, then possibly increase to about 490 million tons by 1990 (table 3). Consequently, coal's contribution to Soviet primary energy production would continue to decline from the 25-percent share posted in 1980.

The key Soviet coal basins during the 1980s will be Donets, Kuznetsk, Ekibastuz, and Kansk-Achinsk. Practically all of the increase in coal output during the decade will come from expanded operations at Ekibastuz, with Kansk-Achinsk providing the rest. After 1985 these two basins will account for 20 to 25 percent of total Soviet coal production (they produced about 14 percent in 1980). Little, if any, increase is likely from other basins during the 1980s.[13] The outlook for production at major basins during the 1980s is presented below.

25X1

Donets Basin. Coal production in the Donets basin, which declined from a peak of 225 million tons in 1976 to 198 million tons in 1981, will continue to fall during the 1980s. After more than two centuries of mining, the easily exploitable reserves in this basin have been exhausted. We believe that production will drop to 190 million tons by 1985 and to 175-180 million tons by 1990.

25X1

25X1

Mine depletion is running at about 3.5 million tons per annum (up from about 2.2 million tons a decade ago). At this rate, the Soviets would have to put about 18 million tons of new coal-mining capacity on line during 1981-85 just to maintain Donets output at the

[13] The Neryungrinsk mine in the South Yakutiya coal basin will increase output during the 1980s. Most of its output will be exported to Japan under long-term contract and thus will have no significant effect on domestic supply.

25X1

25X1

present level. Moscow has announced plans to commission 20 million tons of new capacity in the basin by 1985, but work on the new mines is lagging. At best, seven to 12 years elapse between the decision to build a new coal mine and that mine's reaching full capacity; therefore none of the planned new Donets mines will come into production until the late 1980s at the earliest. 25X1

On balance, we believe that production in the Donets basin will decline by an average of almost 3 million tons annually during the 1980s. This estimate assumes (perhaps optimistically) no further declines in labor productivity. The coal industry probably hopes that the 1982 wage hikes will attract more labor to Donets mines. However, a slowdown in growth of the labor force and poor working conditions of the mines will limit recruiting possibilities. 25X1

Kuznetsk Basin. Production in the underground and open pit mines of the Kuznetsk basin has been lagging since 1975 because of labor shortages and delays in commissioning new coal-mining capacity. After reaching 149 million tons a year in 1978, output fell to 144 million tons in 1981—5 million tons below plan. Soviet officials reported that no new coal mines were commissioned in the basin in the last 10 years. This stagnation is due in part to bureaucratic fighting between agricultural and coal-mining interests over the best use of land in the open pit mining area.[14] Also clouding the outlook for Kuznetsk production is the failure to improve the productivity of the existing underground mines by modernizing and reconstructing them. 25X1

Fragmentary evidence suggests that mine depletion in the Kuznetsk basin was on the order of 750,000 tons per annum in the 1970s. If this estimate is essentially correct, the Soviets will have to commission about 4 million tons of capacity during 1981-85 merely to prevent further declines in production. This they cannot do. Construction of new mines at the basin was not due to begin until 1984, but work was started in 1982 as concern over production shortfalls mounted. Despite the speedup, the new mines will not produce until after 1985 at the earliest.

[14] *Izvestiya*, 10 July 1981, p. 2.

The Soviets originally hoped to produce 160-175 million tons in the Kuznetsk basin by 1985, but this goal has been reduced to 154 million tons. We believe, however, that lags in commissioning of new capacity will prevent them from reaching even the revised goal. Production in the Kuznetsk basin will probably hover at about 140 million tons through the mid-1980s and then increase gradually toward the end of the decade as new capacity begins to come on stream.

Ekibastuz Basin. Soviet plans call for coal production from the Ekibastuz open pit mines to increase from 66 million tons in 1980 to about 84 million tons by 1985 and possibly 124 million tons by 1990. Although production has grown rapidly, Ekibastuz still has serious problems. Mining techniques there are slipshod even by Soviet standards, and the coal—as noted above—is of poor quality.[15] 25X1

Ekibastuz coal has been blamed for numerous shutdowns of power plants. According to a *Pravda* article, 46 percent of the basin's output consists of rock or useless debris. The report concluded that a coal washing plant could reduce the debris content to 38 percent—still about double the maximum acceptable standard for coal used in US power plants. Work on a washing plant to clean the coal is under way but has been proceeding slowly; the plant probably will not be completed until the mid-1980s. Even then it will process only about one-fifth of the basin's output. 25X1

Most of the Ekibastuz coal will be used at five coal-fired thermal power plants to be built in Kazakhstan. Each of these plants is to have a capacity of 4,000 megawatts, and together they will consume 85 million tons of coal per year. The first plant is half completed and could become fully operational in the next two years. The second plant is under construction and may be half completed by the mid-1980s. The Soviet goal to complete four of the five planned plants by 1990 is probably unrealistic. Full utilization of the mine-mouth power plants also depends on the completion of 1,150-kilovolt (kV) and 1,500-kV power lines to the

25X1

[15] For descriptions of Ekibastuz mining techniques and Soviet comments on Ekibastuz coal quality, see *Sotsialisticheskaya industriya*, 11 May 1980, p. 2, and *Current Digest of the Soviet Press*, vol. 31, No. 9, 28 March 1979, p. 11.

25X1 25X1

Urals, because Soviet projections show that local electricity demand will account for only 45 percent of the total output of these power plants. However, the 1,150-kV line was not completed during 1976-80 as originally planned, and construction delays since 1980 are likely to postpone electricity transmission to the Urals until after 1985. The 1,500-kV power line is only scheduled for partial construction and testing by 1985; it is unlikely to be used commercially until the late 1980s. 25X1

If coal production at Ekibastuz were geared only to the needs of the four power plants in Kazakhstan, maximum output of the mines would not be reached until the 1990s. It is more likely, however, that the Soviets will push for production at Ekibastuz substantially in excess of the local power plant requirements to help offset the decline in coal production elsewhere. However, if Ekibastuz coal is not burned locally using specially designed equipment, then its shipment will further burden the rail system and its low quality will reduce power plant performance in other areas. 25X1

Kansk-Achinsk Basin. The Soviets decided to proceed with development of the giant Kansk-Achinsk coal basin in eastern Siberia in the late 1970s. But they still have not settled on a long-range development strategy.[16] Like Ekibastuz coal, the Kansk-Achinsk coal has a low heat content—65 percent that of Donets coal—and none of it is suitable for metallurgical coke. Soviet scientists, engineers, and economists have devoted much attention over the past 10 to 15 years to developing an economical technology for exploiting Kansk-Achinsk coal. Variable physical and chemical properties make its direct shipment to power plants in the western USSR highly uneconomical; Kansk-Achinsk coal is subject to spontaneous combustion in storage and transit and will freeze in cold weather. Proposed solutions have involved two general approaches:

- Extracting the energy content of the coal in power plants near the mines in central Siberia and transmitting the power to the western USSR over very-high-capacity lines.
- Upgrading the coal quality through processing in facilities near the mines and transporting the resulting semicoke, thermocoal, or liquid fuel to the western USSR.[17]

Present plans for Kansk-Achinsk call for a mix of these two options—two or three mine-mouth power plants are scheduled for completion by 1990, and research and future expansion are to be concentrated on technologies for upgrading coal. This strategy for Kansk-Achinsk development is a considerable departure from plans of the mid-1970s, which envisioned 10 mine-mouth power plants connected by ultra-high-voltage power lines to the European USSR and no commercial exploitation of upgraded coal. 25X1

The long-distance power transmission option depends on the Soviets' achieving research breakthroughs on a combustion system for Kansk-Achinsk coal and an ultra-high-voltage (UHV) power transmission system. The variable physical and chemical properties of raw Kansk-Achinsk coal require development of special coal-handling equipment, while the economics of power plant construction specify that the combustion system be very large to avoid the additional costs that constructing and operating multiple smaller plants would entail.[18] No satisfactory solution has been found for coping with the equipment-fouling characteristics of Kansk-Achinsk coal, although it has been tested in small boilers since 1975. 25X1

A more important limitation on mine-mouth power generation is the lack of a UHV transmission system. Soviet researchers state that power lines of 2,200 to 2,500 kV are needed to link Kansk-Achinsk power plants to the central industrial regions. No system now in operation in the USSR has power lines with 25X1

25X1

[16] Absence of a consistent Kansk-Achinsk development strategy is evident in the recent overview of the power industry edited by A. M. Nekrasov and A. A. Troitskiy, Moscow, 1981, *Energetika SSSR v 1981-1985 godakh*, pp. 120-122. 25X1

[17] Robert W. Campbell, 1980, Indiana University Press, *Soviet Energy Technologies*, pp. 170-184. 25X1

[18] We are using the term "combustion system" to indicate the many technologies needed to burn coal to generate steam for power generation. These technologies must cope with problems of: (1) transportation of the coal from mines (via railcars, pipelines, large-capacity vehicles, or conveyer belts) to power plants, (2) coal pulverization and grinding, (3) design, construction, and operation of boilers to provide enough steam to run 800-megawatt turbines, (4) formation of slag deposits on boiler heat-exchange surfaces (which reduce heat transfer, lower output, and increase maintenance), and (5) air and water pollution caused by ash residue in boilers and smokestacks. 25X1

voltages higher than 800 kV; 1,150-kV and 1,500-kV systems are only in the commercial demonstration phase of testing. The Soviets have not yet shown more than a small-batch production capability for the auxiliary equipment that would be required for a 1,500-kV line on which construction began last year. They estimate that this line will require a construction period of six to eight years, plus several more years to achieve normal operation. We estimate, therefore, that a transmission system of 2,000 to 2,500 kV is at least 12 to 15 years (and probably closer to 20 years) away from implementation

To accelerate Kansk-Achinsk development, some Soviet planners have proposed sending electricity from mine-mouth power plants to the Urals, some 1,200 kilometers closer to Kansk-Achinsk than the central region. Such proposals are attractive because they could cut development time for Kansk-Achinsk. Power lines of 1,150 and 1,500 kV could be constructed as much as a decade earlier than the higher voltage systems that now are only in early phases of research. However, plans to develop Kansk-Achinsk as a source for Urals electricity ignore the growing power needs of the central region and other planned projects for increasing electricity transfers to the Urals. According to existing goals for the 1980s, the Urals would receive major increases in electricity from both Ekibastuz and Tyumen'. If additional power is transmitted from Kansk-Achinsk to the Urals, then the region would not be able to use this electricity without substantial industrial expansion or a major substitution of electric power for other energy sources. Neither of these programs is contemplated in existing plans. 25X1

Conversion of the low-quality Kansk-Achinsk coal into upgraded products—semicoke, thermocoal, or synthetic liquid fuels—would make it transportable over long distances and usable in a variety of boilers. However, processes for drying, pyrolysis, and hydrogenation of Kansk-Achinsk coal are only in the pilot-plant stage of development. These processes must be further perfected in pilot-plant testing, then re-engineered for a commercial-scale facility. Commercial output will become available only after production plants are built and operating. The most advanced of the coal-conversion processes (semicoke production) is still eight to 10 years from commercial operation.

The Soviets' difficulties do not end here, however, because the enriched solid or liquid product must be transported thousands of kilometers to the European USSR. Transportation of more than 45 million tons annually by rail would require considerable investment (perhaps as much as 5 billion rubles) in an expanded rail network and coal cars—plus additional operating costs of 100 million rubles per year. Various types of pipeline shipment (slurry lines, capsule pipelines) are under study, but large-volume, long-distance transfers are beyond current Soviet capabilities. The slurry pipelines operated to date have been on the order of only tens of kilometers. Capsule pipeline transport is undergoing laboratory-scale trials, but Soviet researchers have stated that the technique is being considered only for short distances (5 to 20 kilometers). 25X1 25X1

Because of delays already encountered in developing the technologies needed for any of these strategies (to transport Kansk-Achinsk coal, to build boilers adapted to burning it, to transmit UHV power over vast distances), we rule out the possibility that Kansk-Achinsk will be a significant factor in Soviet energy plans until the 1990s at the earliest. We expect, however, that raw coal production in the Kansk-Achinsk basin will increase from 35 million tons in 1980 to about 48 million tons by 1985 and possibly 65 million tons by 1990. Even this modest progress may be slowed if Soviet authorities heed the warnings of environmental specialists that the currently planned development of Kansk-Achinsk would cause serious air and water pollution problems. 25X1

Other Basins. Little if any increase in production is likely at other Soviet coal basins during the 1980s. The Soviets hope to maintain output at about 50 million tons at Karaganda and 28 million at Pechora. They originally planned to begin phasing out operations at the Moscow coal basin after 1985 and to stop entirely by 1990. The Moscow basin will probably stay in operation longer, however, to help offset declines elsewhere. The Neryungrinsk mine in the South Yakutiya coal basin is scheduled to increase production to 12 million tons during the 1980s. At

25X1

Table 4
Cost of Coal Production, by Basin [a]

Rubles per metric ton of standard fuel equivalent

	1960 [b]	1965 [b]	1970 [c]	1975 [d]	1980
Donets (underground)	12.7	14.4	15.4	17.0	17.7 [e]
Kuznetsk (open pit)	5.5	6.2	6.6	8.6	9.7 [f]
Pechora (underground)	14.3	16.5	15.5	NA	20.6 [e]
Moscow (underground)	NA	NA	NA	24.1	25.0 [g]
Karaganda (underground)	8.2	10.8	10.9	12.8	13.0 [e]
Ekibastuz (open pit)	NA	NA	NA	2.5	4.6 [f]
Kansk-Achinsk (open pit)	NA	NA	NA	2.4	5.5 [f]

[a] The figures show average cost in current prices per physical unit of output, including a 12-percent interest charge on the stock of reproducible fixed assets. If expressed in constant-factor prices, the increase in cost would be somewhat less.
[b] Source: *Tsena, sebestoimost' i rentabel'nost' v ugol'noy promyshlennosti,* Nedra, Moscow, 1974, p. 57, and *Territorial'naya differentsiatsiya tsen v tyazheloy promyshlennosti*, Ekonomika, Moscow, 1974, p. 21.
[c] Source: *Voprosy ekonomiki,* June 1971, p. 37.
[d] Source: *Planovoye khozyaystvo,* No. 6, 1975, p. 66.
[e] Calculated from *Planovoye khozyaystvo,* No. 11, 1977, p. 142.
[f] Estimated from data in *Gidrotekhnicheskoye stroitel'stvo,* No. 5, 1980, pp. 20-22.
[g] Calculated from *Elektricheskiye stantsii,* No. 12, 1978, p. 13.

[redacted] 25X1

maximum output, about 9 million tons of coking coal will be processed for export to Japan under a long-term contract and some 3 million tons of steam coal will be used by Soviet power stations. Geological survey and exploration work has located new coalfields in the Kazakh SSR, the Turgay basin, and along the Baikal-Amur Mainline railroad (BAM). However, these new coal deposits are neither close to consumers in the European USSR nor of high quality. The new coal finds merely assure the Soviets of coal availability in the very long term. [redacted] 25X1

Production Costs. Coal production and investment costs have risen steadily in the last two decades, driven upward by deteriorating conditions in underground mines and by growing infrastructure outlays for major open pit mines. Both average costs of current production and marginal costs for gaining an additional ton of output grew during the 1960s and 1970s. Average mining costs (including charges on plant and equipment) in the Donets basin were 17.7 rubles per metric ton of *standard fuel* in 1980—almost double the cost of open pit mining at Kuznetsk and about four times the cost of surface-mined coal at Ekibastuz (table 4). Even after adding transportation charges, the cost of Ekibastuz coal delivered to Moscow, for example, is still 15 percent less than the delivered cost of Donets coal. [redacted] 25X1

Expansion of the open pit mines of Ekibastuz, Kuznetsk, and Kansk-Achinsk will be less costly overall than expansion of western basins, by a wide margin. However, the Soviets expect the cost advantage to narrow somewhat during the 1980s, because marginal costs of production at the large open pit mines will rise faster than those at Donets (table 5). Costs for new 25X1

Table 5
Comparison of Marginal Costs of Coal Production, by Basin, 1980 and 1985-90 [a]

Rubles per additional metric ton of standard fuel equivalent

	1980	1985-90 (Soviet Projections)	Increase (Percent, Midpoint of Range)
Donets (underground) [b]	20-23	33-35	58
Kuznetsk (open pit) [c]	10-12	17-20	68
Pechora (underground) [b]	19-22	35-38	78
Moscow (underground) [b]	26-27	34-36	32
Ekibastuz (open pit) [d]	3-5	7-10	113
Kansk-Achinsk (open pit) [b]	2.5-3.5	6-8	133

[a] Soviet estimates of marginal cost in current prices for the production of an additional ton at new mines (both in construction and planned). Marginal cost includes a 12-percent interest charge on stock of reproducible fixed assets.
[b] Source: *Gidrotekhnicheskoye stroitel'stvo,* No. 5, 1980, p. 22.
[c] Calculated from *Ugol',* No. 1, 1981, p. 29, *Elektricheskiye stantsii,* No. 12, 1978, p. 13, and *Teploenergetika,* No. 2, 1980, p. 7.
[d] Source: *Planovoye khozyaystvo,* No. 8, 1980, p. 11, and *Elektricheskiye stantsii,* No. 10, 1979, p. 8.

[redacted] 25X1

capacity in the underground mines of the Donets, Moscow, and Pechora basins will increase by roughly 30 to 80 percent, mainly because mines will be deeper and coal seams thinner. At Ekibastuz and Kansk-Achinsk open pit mines, however, an additional ton of output will double in cost by the mid-1980s. Although operating costs per ton of coal produced by open pit mines at Ekibastuz are falling as a result of economies of scale, the total cost of new production is rising because the Soviets are adding a major share of infrastructure expense to the direct mining costs. In 1980 an additional ton produced at the basin with the highest costs (Moscow) was 6.5 times the cost of a ton produced at Ekibastuz. An additional ton produced at the highest cost basin of the mid-to-late 1980s (Pechora) will be 4.5 times the cost of new production at Ekibastuz mines. [redacted]

In terms of incremental investment costs, the picture is much the same. Investment per ton of *standard fuel* (excluding infrastructure) for new mines is 70 to 80 rubles at the Donets basin and 90 to 95 rubles in the Moscow basin, while it is about 12 rubles at Ekibastuz and 10 rubles at Kansk-Achinsk. In terms of the energy return on investment, Ekibastuz or Kansk-Achinsk would supply more energy per ruble invested than any other coal basin. Roughly calculated, the investment now needed to achieve a 1-ton increase in standard fuel at the Donets basin would yield an additional 5 to 7 tons at Ekibastuz or Kansk-Achinsk. [redacted] 25X1

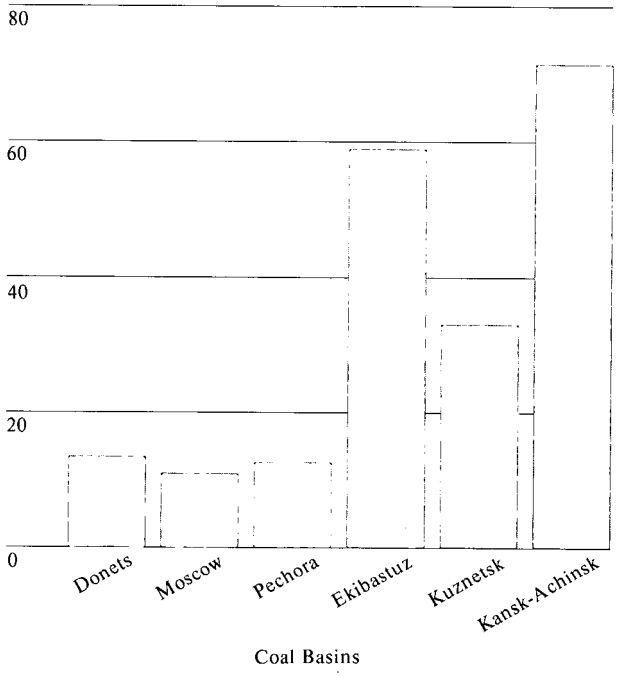
When outlays for construction of support facilities are added to the direct investment costs of Kansk-Achinsk coal, investment per ton of standard fuel rises by nearly 40 percent—from 10 to nearly 14 rubles. Inclusion of such indirect mining costs reduces the cost advantage of Kansk-Achinsk coal so that the investment needed in the 1980s to achieve a 1-ton increase in standard fuel at the Donets basin would only yield an additional 4 tons at Kansk-Achinsk (figure 4). [redacted] 25X1

The advantages of developing the Ekibastuz and Kansk-Achinsk basins are not as clear cut as their relatively low production and investment costs appear to indicate. Other coal basins and other fuels can be more attractive energy investments. The low quality of Ekibastuz and Kansk-Achinsk coals and the high infrastructure costs associated with production in these basins offset to a considerable extent their low extraction costs. In addition, because of limited transportation capacity, movement of supplies from these two basins to the industrial heartland of European Russia (including the Urals) is constrained. Even if the technical problems for converting low-quality coal into enriched fuel products and into electricity could be overcome, the additional capital and operating outlays may result in a cost per delivered unit of energy on a par with that of the established basins. [redacted]

Although a general discussion of comparative costs for fossil-fuel production is beyond the scope of this paper, we can compare coal extraction costs to a key alternative, Tyumen' natural gas. Soviet data for 1980 show that gas from Tyumen' is roughly equal in production cost to either Ekibastuz or Kansk-Achinsk

25X1 25X1

Figure 4
Estimated Increase in Coal Supply Per Thousand Rubles of Investment



25X1

587535 9-82

coal. For equivalent amounts of energy, Tyumen' gas investment requirements are slightly greater than those for either Ekibastuz or Kansk-Achinsk coal, while operating costs for Tyumen' gas recovery are somewhat lower than operating costs at either coal basin. The resulting inconclusive indications for policy have contributed to the continuing tension between advocates of coal development and advocates of other fuels. 25X1

Impact of Coal Shortages

Tight supplies of coal will severely undercut Soviet plans to increase the use of coal in the production of electric power during the 1980s. Moreover, coking coal production will become a major bottleneck, substantially limiting the possibility for gains in steel

Table 6
Fuel Consumption at Electric Power Plants [a]

Percentage share

	1975 Actual	1980 Plan	1980 Actual	1985 Plan
Coal	45	46	37	40
Oil	30	28	36	26
Gas	22	22	24	32
Other	3	4	3	2

[a] Data shown are for fuel consumption at power plants under direct control of the Ministry of Electric Power (about 90 percent of Soviet thermal power stations).

25X1

production. The production of these two—electric power and steel—accounts for about three-fourths of Soviet coal consumption. 25X1

Electric Power. Soviet energy policy has recently stressed the reduction of the share of oil in the total amount of fossil fuels consumed at power plants. According to the guidelines of the 1976-80 Plan for the Ministry of Electric Power, the share of oil was to drop and the share of coal was to rise. As shown in table 6, the hope was not fulfilled. Partly because coal supplies were tight, the share of coal in power plant fuel fell, while the share of oil rose substantially. 25X1

The 1981-85 Plan calls for a marked drop in the oil share. The Soviets hope to replace oil in electric power production by increasing the use of both coal and gas. Because coal production will lag, we believe the share of coal in power plant fuel consumption is more likely to continue to decline. Therefore, the Soviets must boost gas consumption above the already sizable increase targeted for 1985 if power plant oil use is to be limited. 25X1

Tight coal supply has not stopped the Electric Power Ministry from planning and constructing substantial new capacity in coal-fueled power stations. The Power Ministry has 16 large coal-fired thermal power plants

in the building or planning stages and expects them to be completed during the 1980s. At capacity these 16 plants would require 172 million tons of low-grade raw coal—equivalent to about 86 million tons of standard fuel. In 1980, the last year for which complete data are available, the power industry consumed (in terms of standard fuel) 508 million tons of fuel, of which coal provided 189 million tons. If all of the new coal-fired power plants were to come on stream, coal demand in electric power production would increase by nearly half, to 275 million tons per annum in standard fuel units.[19]

Meeting the increased needs of the power industry—while maintaining allocations to all other industrial sectors and to exports at the 1980 level—would require total Soviet coal production to grow to about 523 million tons of standard fuel by 1985, equivalent to almost 785 million tons of raw coal. As indicated above, we believe that this level of output is beyond Soviet capabilities until the 1990s at the earliest. In this circumstance, the Soviets probably would not push construction of new coal-fired power plants but rather stretch it out to balance coal supply and demand.

If the needs of the electric power industry were to be fully met and if our projection of Soviet coal production is correct, the availability of coal for all other uses would drop by about 15 percent by 1985 and 30 percent by 1990 compared with 1980. Table 7 shows this projection. Decreased coal supplies would exacerbate the Soviets' energy problems, given their requirements for coal in high-priority sectors like iron and steel, nonferrous metals, and petrochemicals, all of which use coking coal as a chemical reactant.

Steel. Supplying an adequate quantity and quality of coking coal to the steel industry will also challenge Soviet planners during the 1980s.[20] On the basis of

[19] Some existing coal-fired power plants will be retired during the 1980s (about 5,000 MW of capacity), but planned construction of small coal-fueled plants would more than offset these retirements. Therefore coal demand at power plants would probably be more than 275 million tons if power plant construction proceeded as planned.

Table 7
Estimated Coal Availability, Assuming That Plans for Use in Electric Power Are Met

Million metric tons of standard fuel

	1980	1985	1990
Coal production	484	480	490
Less			
Electric power [a]	189	228	275
Net exports	15	15	15
Available for other domestic uses	280	237	200

[a] We assume that about one-third of the new capacity will come on stream by 1985 and the other two-thirds by 1990.

their published plans for steel production and of our own detailed activity analysis of the ferrous metals industry, we have estimated the Soviets' needs for coking coal in 1985 under three different scenarios. (These are illustrated in table 8, with details in the appendix.)

If the Soviets try to meet their planned 1985 crude steel production goal of 168 million tons and also to meet the demand of all other consumers at or near the 1980 levels, including export commitments, they will need nearly 150 million tons of clean coking coal (215 million tons of raw coking coal). As indicated in the table's scenario A, this would require a huge increase in coking coal imports. Given declining coal production at the Donets and Kuznetsk basins, we estimate that Soviet production of raw coking coal will drop from about 178 million tons in 1980 to about 170 million tons (119 million tons, clean basis) in 1985 and to 168 million tons in 1990 (table 9)

Falling coking coal production will force the Soviets to choose among several alternatives. They could change the pattern of domestic allocations, trim their plans for steel production, substantially increase coking coal imports, or eliminate exports—or, more likely, adopt some combination of these options. Although we cannot predict the Soviets' choice, we can describe the size of their problem.

Table 8
Soviet Requirements for Clean Coking Coal in 1985 Under Alternative Scenarios

Million tons of clean coking coal

	1980	1985 Scenarios		
		(A) Increased Imports	(B) Cuts for Nonsteel Industries	(C) Cuts for Steel Industry
Total supply	**129**	**150**	**123**	**123**
Production	125	119	119	119
Imports	4	31	4	4
Total distribution	**129**	**150**	**123**	**123**
Steel	75	97	80	72
Other industries	45	42	34	42
Exports	5	5	5	5
Losses	4	5	4	4

Note: Because of rounding, components may not add to the totals shown. All data are expressed as clean coking coal (to convert raw coking coal to clean coking coal, multiply by 0.7). Coking coal imports adjust in scenario A and are fixed at estimated 1980 levels in B and C. The allocations of coking coal to industries other than steel shown in scenarios A and C are estimated from 1980 regional data; they are adjusted downward in B. Steel production adjusts in scenario C. A constant 5-percent transport loss is assumed in shipments to the steel industry.

25X1

[redacted]

Moscow could cut allocations of coking coal to industries other than steel to help ensure that the needs of ferrous metallurgy are fully satisfied. We estimate that about 40 percent of total Soviet coking coal supply is used in the nonsteel applications, primarily in the production of petrochemicals, nonferrous metals, and electric power. Of this coal, about two-thirds is burned as boiler fuel and the balance is coked. If coking coal imports were held constant and the requirements of ferrous metallurgy were fully met, allocations of coking coal to other domestic industries in 1985 would have to be held about 25 percent below 1980 levels (scenario B). Soviet sources indicate that such a policy would create supply imbalances in the electric power, petrochemical, and nonferrous metal industries.[21] This option is therefore probably not a realistic choice; the power industry, which has the highest civilian fuel priority, would face about a 3-percent cut in its coal supply [redacted] 25X1

Alternatively, if coking coal imports and the needs of all other consumers (including exports) were held at 1980 levels, the supply of clean coking coal available for ferrous metallurgy would drop about 4 percent (from 75 million tons in 1980 to 72 million tons in 1985, as shown in scenario C). Reduced allocations of coking coal would severely reduce pig iron production and thereby wreck Soviet plans to increase crude steel production. We estimate that crude steel production in 1985 with such a reduction in coal allotment would be about 150 million tons. This would be a 2-million-ton increase over production in 1980, but only 10 percent of the planned increase. We consider this

[21] M. V. Golitsyn, 1980, *Sovetskaya geologiya*, No. 4, pp. 11-29, provides information on the importance of coking coal to electric power, petrochemical, and nonferrous metal industries [redacted] 25X1

Table 9
Soviet Production of Raw Coking Coal, by Basin

Million metric tons

	1970	1975	1976	1977	1978	1979	1980	1985	1990
Total	**164.8**	**181.0**	**186.2**	**186.3**	**182**	**181**	**178**	**170**	**168**
Donets	84.3	88.5	88.1	86.8	82	80	74	67	68
Kuznetsk	46.9	56.1	59.4	59.9	60	60	55	53	53
Karaganda	16.9	18.1	18.9	19.0	19	19	27	26	23
Pechora	12.1	14.1	16.0	16.7	17	18	18	19	19
Other	4.6	3.9	3.8	3.9	4	4	4	5	5

Note: Because of rounding, components may not add to the totals shown. The total does not include output at Neryungri in the South Yakutiya coal basin. (Coking coal production there is scheduled to increase to 6 million tons by 1985 and 13 million tons by 1990, but all of it will be exported to Japan under a long-term contract and thus will have no effect on domestic supply.) The data through 1978 are based on No. 4 issue of *Ugol'*, 1968-78; those for 1979-90 are CIA estimates.

25X1

25X1

option also to be unrealistic, because shortages of steel products are already plaguing many sectors of the Soviet economy.

The Soviets could try to import more coking coal, to help balance supply and demand for that commodity; but such a policy will be unpalatable in a time of increasing hard currency stringencies. To fully meet all needs (scenario A), the Soviets would have to increase annual imports of clean coking coal to over 30 million tons by 1985, compared with annual imports of about 4 million tons in 1980. At current market prices—$60 per metric ton—imports would cost roughly $1.8 billion per year.

25X1

The Soviets could also trim exports, especially to Eastern Europe, to help offset part of the domestic coal production shortfall. This policy could be implemented without causing disruptions in Eastern Europe only as long as increased Polish coal exports were available. However, the uncertainty of exports from Poland—presently a major supplier to other East European countries—makes this a risky policy. Polish coal production during 1981 was down about 16 percent from that of 1980, and exports were off 50 percent. Both production and exports rebounded in early 1982, but neither Moscow nor Warsaw can be confident that this trend will be sustained.

25X1

Some reduction in Soviet sales to hard currency countries is likely, but such reductions cannot help much, because of the comparatively small amounts involved—less than 3 million tons per year. Moreover, nearly all Soviet coking coal exports to hard currency countries are under long-term contracts. Although we cannot rule out the possibility, we doubt that the Soviets would renege on long-term agreements, except under the most extreme circumstances.

25X1

Appendix

Soviet Coking Coal Requirements in 1985

We estimate that the Soviets will need 210-215 million tons of raw coking coal to meet the 1985 Plan for steel production and, at the same time, maintain coking coal allocations to other uses (including export commitments) at or near 1980 levels.

Ferrous metallurgy will account for some 140 million tons of the 1985 requirement for raw coking coal. About 11 percent of the coke consumed in ferrous metallurgy will continue to be used outside the blast furnace for iron ore preparation and other production activities.

Our estimate for coking coal use in ferrous metallurgy includes projected consumption of 125 million tons of raw coking coal for the smelting of iron ore. This is based on the following assumptions:

- Production of 1 ton of pig iron requires 0.53 ton of coke.
- Production of 1 ton of coke requires about 2 tons of raw coking coal (a standard conversion).
- The Soviets plan to produce 118 million tons of pig iron in 1985.

Thus, the production of 1 ton of pig iron requires 1.06 tons of raw coking coal, and the production of 118 million tons of pig iron requires 125 million tons of raw coking coal.

Other industrial uses, together with exports, are estimated to continue at the 1980 level of about 70 million tons.

Transportation losses are estimated at 5 percent of the total coke demand for use in ferrous metallurgy. Losses for 1985, accordingly, would be 7 million tons.

[redacted] 25X1